TECHNICAL PROVISIONS

1. GENERAL INFORMATION:

These Technical Provisions are for the work as described herein in conjunction with the associated project plans and other related documents. The construction drawings are to be considered a part of these specifications bound herein. It is understood that these improvements are intended to become the property of the City of West Linn upon completion and acceptance by the City's representative.

2. SANITARY SEWER MAIN CLEANING AND TV INSPECTION

PART 1 GENERAL

A. Description

1. This section includes all labor, materials, equipment, and incidentals necessary for cleaning and internal TV inspection of sanitary sewer main lines. Work under this section shall include, but not be limited to: cleaning of mainlines and manholes and TV inspection of designated sanitary sewer main lines, traffic control as shown or required by all local, state, and federal agencies, and all other incidental work specified or shown in the Contract Documents.

2. Contractor shall perform all work in accordance with Federal OSHA and State safety requirements, including those for confined space entry.

B. Submittals

1. Submittals shall be in accordance with the requirements of these Contract Documents, and shall include the following:

2. Information on all cleaning and TV inspection equipment proposed for use by the contractor, including a listing of size, type, and capabilities of each piece of equipment that meet all specifications within this document.

3. A traffic control plan that shall include but not be limited to: staging sites, impacts to traffic patterns, considerations of bus traffic, as well as proposed signs, detours, and flaggers. See Technical Provision.

C. Contractor's Record Drawings

1. The contractor shall maintain a detailed record, including a neatly marked set of construction drawings if applicable, of the sanitary sewer pipes associated with this work, including but not limited to: any differences in alignment, pipe size, and manhole

or cleanout location discovered during the progress of the work. Records and drawings shall be kept current with the work as it progresses and shall be subject to inspection by the City's representative at any time.

2. The location, alignment, lengths, and sizes of the sanitary sewer lines shown on the drawings are compiled from available records and/or field surveys. The City does not guarantee the completeness or accuracy of such records. ***All dimensions shall be verified by the contractor.***

PART 2 PRODUCTS

A. Water for Cleaning

1. The City will approve a hydrant for use. The contractor shall provide a double check valve and appropriate water truck meeting AWWA and City requirements. The contractor will keep a log of water use and provide it to the City.

B. Cleaning Equipment

1. General - The contractor shall furnish and utilize a combination of high velocity hydraulic cleaning equipment and a vacuum unit as specified or required. High velocity cleaning equipment shall be used to clean all sewer mainlines unless otherwise specified or approved by the City's representative. Low velocity or mechanical cleaning equipment shall not be used in lieu of high velocity equipment.

2. High Velocity Cleaning Equipment with Vacuum Pickup of Materials

a. High velocity cleaning equipment shall be capable of providing minimum 60 or higher gallons per minute at 2,000 pounds per square inch (psi) of working pressure. Contractor shall provide a minimum of 500 feet of 1-inch ID high-pressure hose with at least two cleaning nozzles. The nozzles shall be capable of producing a scouring action from 15 to 45 degrees in all size lines designated to be cleaned. The equipment shall also include a high velocity "gun" for cleaning manhole walls and bottoms. The equipment shall be complete including 1,200 gallon water tanks suitable for holding corrosive or caustic chemicals, pumps, hose, hydraulically driven hose reel, auxiliary engines, controls, and all safety features required by law.

b. The cleaning equipment shall have an integral vacuum unit to allow the material cleaned from the pipes to be vacuumed directly from the manhole.

c. Contractor shall provide additional cleaning equipment, including root cutters, as required to satisfactorily clean the pipe as determined by the City's representative.

C. TV Inspection Equipment

1. A closed circuit color television (CCTV) camera capable of providing still pictures and videos shall be used on all lines. The CCTV equipment shall be specifically designed for sewer inspection operations and shall be operative in 100 percent humidity conditions. Lighting and camera quality shall be suitable to allow a clear focused picture a minimum of six linear feet in front of the camera of the entire inside periphery of the pipe. The camera shall have an adjustable focus distance from six inches to infinity, and the camera lights shall be variable intensity, with light, focus, and aperture remotely controlled by the operating technician at the monitoring station.

2. Camera travel speed shall be from 1.8 to 30 feet per minute (fpm) with smooth, uniform motion. Sudden stops and starts will not be acceptable. Camera shall be capable of stopping and reversing direction as necessary to document sewer conditions. Video pictures shall be clear, sharp, and free from vibratory or electrical interference when the camera is in operation.

3. A CCTV camera with pan-tilt capabilities shall be used on all lines larger than six-inches in diameter. The CCTV camera shall be a tractor-powered camera being able to inspect dead end lines, and shall be remotely controlled by an operating technician.

4. The monitoring station shall be truck-mounted, capable of seating two viewing personnel and one operating technician. The monitoring station shall be fully enclosed within a rigid weatherproof enclosure on the TV truck.

5. A minimum of two color display monitors (minimum 650 lines horizontal resolution) operating simultaneously shall be used in the monitoring station. The monitors shall be of a proper size to allow all viewing personnel in the monitoring station a satisfactory view, and shall continuously display the current date, manhole designation of the mainline being inspected, and a continuous forward and reverse read-out of the camera distance from the manhole of reference.

PART 3 EXECUTION

A. Temporary Traffic Control

1. Provide temporary traffic control as specified elsewhere in the Technical Provisions.

B. Maintaining Sewer Flows and Cleaning Precautions

1. All sanitary sewer system components shall remain in service through the cleaning and TV inspection operations unless specific exceptions are approved in writing by the City's representative.

2. During cleaning operations, precautions shall be taken by the contractor in the use of cleaning equipment. When hydraulically propelled cleaning tools which restrict the flows in the sewer lines are used, precautions shall be taken to insure that the water pressure created does not damage or cause flooding of public or private property being served by the sewer. Precautions shall be taken to protect the sewer lines and manholes from damage that may result from the improper use of cleaning equipment. The contractor shall be solely responsible for the repair of any damage to structurally sound lines or to properties connected to the sewer resulting from the cleaning operations.

3. The methods used to maintain flows shall be at the contractor's option and may include use of flow-through plugs with periodic release of sewage flow or bypass pumping. The bypass system, if used, shall be capable of conveying flows when the sewers are flowing full.

C. Cleaning

1. Clean all sewer lines and manholes designated on the drawings or directed by the City's representative prior to CCTV inspection including the manholes at both ends of the section to be inspected.

2. All dirt, sand, grease, rocks, roots, or other accumulations shall be removed from pipe walls and manholes. Existing lines shall be protected from damage caused by cleaning operations. Hydraulic cleaning operations shall be conducted with care to avoid damage to pipes and manholes, or flooding of adjacent property.

3. All sewers shall be cleaned with high velocity equipment. The City's representative may order the use of other methods or equipment when it appears necessary.

4. All materials removed from the pipes during the cleaning operations shall be collected by a vacuum unit from the manhole downstream of the section being cleaned and removed by the contractor. Passing accumulated materials from manhole section to manhole section shall not be permitted.

5. The contractor shall be responsible for the proper and legal disposal of all materials removed from the sewers and in a manner acceptable to the City's representative.

6. Manhole and sewer cleaning reports shall be submitted on forms that provide all essential data, including:

    a. Location of mainline segment or manhole being cleaned (street name and manhole designation as shown on the drawings);

    b. Diameter of sewers, in inches;

c. Estimated amount and type of material removed from pipe or manhole.

7. Two copies of the typed Mainline Cleaning Report forms shall be furnished to the City's representative as specified below.

8. Acceptance of the cleaning work will not be made until after the submittal of the cleaning reports and the CCTV inspection reports and records. Lines will be considered acceptably clean when sufficient material has been removed to restore the sewer line to 95 percent of its original flow capacity.

D. Sewage Flow Controls

1. The methods used to maintain flow shall be at the contractor's option and may include the use of flow-through plugs or bypass pumping.

2. During periods of very high flows when lines flow greater than half full, the contractor, with the City's representative's approval, shall suspend sewer cleaning operations until flows are again less than half full.

3. Depths of flow at the downstream manhole during television inspection shall not exceed those shown below when performing television inspection of the lines.

Pipe Diameter (inches)	Maximum Flow Depth % of Pipe Diameter
6 – 10	10
12 – 24	15
30 - 42	20
48 - 72	25

4. When the sewage depth of flow at the downstream manhole of the mainline section being inspected is above the maximum allowable for television inspection, the contractor shall provide flow-through plugs or other means necessary to ensure that the flows are reduced to the levels specified above.

E. CCTV Inspection

1. Internal CCTV inspection of sanitary sewer mainlines as shown on the drawings shall be performed only after the sewers have been thoroughly cleaned so that service connections, cracks, leaks and structural failures may be located.

2. The CCTV inspection shall be performed on one mainline section at a time and between two manholes. Each mainline section being inspected shall be isolated from the remainder of the line as necessary by the use of line plugs or bypass pumping to insure

viewing of the inside periphery of the pipe. The TV inspection shall be performed by moving the television camera through the line along the axis of the pipe. The inspection shall be performed in a forward direction, according to line conditions at the time the inspection is made.

3. The pan-tilt camera shall be turned to view directly up the axis of each service lateral encountered.

4. During the CCTV inspections, an inspection record shall be kept which clearly shows the exact location of each service connection, crack, leak or structural fault discovered, in relation to the centerline of the adjacent manhole.

5. The TV inspection record shall be submitted on forms that provide all essential data, including:

    a. Location of mainline segment being tested (manhole designation as shown on the drawings);

    b. Pipe diameter in inches;

    c. Type and condition of the pipe;

    d. Length and type of joints;

    e. Presence and location of roots or visible leaks;

    f. Location and description of any cracks, breaks, misalignments, or obstructions;

    g. Location and diameter of service laterals, including clock position as viewed from the camera;

    h. Condition of the portion of lateral visible from pan-tilt camera;

    i. Estimates of flows from service pipes is domestic or I/I.

6. Two copies of the printed Television Inspection Report form shall be furnished to the City's representative.

7. All video inspections shall be recorded on a digital portable hard drive together with voice transmissions of sewer conditions. The video records shall be accurately referenced to the corresponding inspection report and shall be organized and catalogued so that specific defects can easily be located.

8. The video shall be created in a format compatible with current personal computers sold in the past five years. Inspection runs shall be numbered sequentially. Each file shall

have a label which lists the date, and the manhole designation as shown on the drawings. The hard drive shall become the property of the City upon payment for the line segments inspected.

F. Report Submittals

All cleaning, TV inspection and manhole inspection reports shall be typed and organized by manhole numbers and submitted to the City's representative.

3. CURED-IN-PLACE PIPE

PART 1 GENERAL

A. Description

This Section includes the work necessary to furnish and install cured-in-place pipe (CIPP). The project locations are shown in the Drawings. The contractor shall provide all materials, labor, equipment, and services necessary for handling of sewage flow including bypass pumping, cleaning and inspection of the existing pipe system, CIPP installation, testing of the lined pipe system, and reconnection of service connections, all as specified herein.

B. Reference Specifications, Codes, and Standards

The following references are part of this Specification, in case of conflict between the requirements of this Specification and those of the listed documents, the requirements of this Specification shall prevail. The latest edition of the following references shall be used:

ASTM F1216-07b	Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube
ASTM D790	Test methods for flexural properties of non-reinforced plastics
ASTM F1743	Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Pulled-in Place Installation of Cured-In-Place Thermosetting Resin Pipe (CIPP)
ASTM D5813	Standard Specifications for Cured-In-Place Thermosetting Resin Pipe (CIPP)
ASTM D2990	Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics

C. CIPP Contractor Qualifications

1. To be eligible to perform CIPP work required in this contract, the contractor must demonstrate to the City's representative their capabilities for installing one of the specified lining products in full accordance with the plans and specifications. Approval will be made based on the City's representative's evaluation of the proposed CIPP contractor's past experience. The proposed CIPP rehabilitation process must be a proven technology, which is defined as a minimum of 100,000 lineal feet of successful sanitary sewer and/or storm water collection system installations in the U.S., documented to the satisfaction of the City's representative.

2. For a CIPP contractor to be considered as qualified, the contractor must satisfy all insurance, financial, and bonding requirements of the CIty, and the Contractor's Project Superintendent (See items D.4 & D.12 of this section) must have successfully installed at least 50,000 feet of the cured-in-place rehabilitation process proposed by the contractor for use on this project. Acceptable documentation of these minimum installations must be submitted to the City. Furthermore, the contractor's Project Superintendent must have a minimum of 3 years of CIPP installation experience, and must be on-site during the installation of the CIPP products.

3. The 3 Year Experience Record Form shall consist of the following:

   a. A 3 Year Experience Record Form signed by the CIPP contractor that identifies previous CIPP rehabilitation projects and the qualifications of the contractor for accomplishing the CIPP work with the proposed CIPP method. The Form shall be submitted to the City with the sealed bid documents proposal. A blank copy of this form is enclosed with supplementary information in the bid document.

   b. The City's representative shall have the right to require a prospective CIPP contractor to clarify any portion of their 3 Year Experience Record Form. Response to such a request must be made in writing and shall become a part of the 3 Year Experience Record Form. Failure to respond to such a request shall be cause for rejection of the 3 Year Experience Record Form.

D. Contractor Submittals

The following submittals shall be provided as per the Technical Provisions. The City's representative may request additional information and or shop drawings.

1. Certification by the lining system manufacturer that the installer is fully licensed and certified as competent to perform the work.

2. Certification from the manufacturer that the materials meet the requirements of these specifications and intended use. Certification of test results confirming that the liner and

resin meet the minimum chemical resistance requirements according to ASTM F 1216 and ASTM F 1743.

3. A list of the key qualified personnel who are assigned to and will work on this project and certification of worker training for installing CIPP liners.

4. Flow diversion plan for the mainline including service laterals if applicable.

5. Detailed method for samplings, including recommended location and size of each sample, method of removal, and method of liner repair including a procedure to repair the cured liner when core/plate samples are taken.

6. Design calculations stamped by a registered professional engineer in the State of Oregon certifying that the structural design requirements outlined in Part 2 of these specifications have been met.

7. Independent third party test results for the gravity CIPP product for approval supporting the structural performance (short-term and long-term) of the product. Test samples shall be prepared so as to simulate installation methods and trauma of the product.

8. Contractor 3-year Experience Record.

9. The contractor shall submit sewage bypass pumping and/or sewage diversion plans for review and approval by the City's representative at least 5 working days prior to commencement of the work. The contractor shall notify the City's representative 24 hours prior to commencing with the bypass pumping operation. See Technical Provision 4, Sewage Diversion Requirements, for more specific requirements.

10. The contractor shall submit a temporary traffic control plan if applicable. The temporary traffic control plan shall conform to the ODOT Temporary Traffic Control Handbook and MUTCD. Contractor shall submit such plan for review and acceptance a minimum of 48-hours prior to construction.

E. Quality Assurance

1. The finished liner shall be continuous over the entire length of an insertion/inversions run between two manholes or access points and shall be free from visual defects such as foreign inclusions, dry spots, de-laminations and lifts. Entire length of the liner shall be visible on the final TV report with waterstop gaskets to be visible at both ends of the new liner and called out. If the final TV report discovers the finished liner pipe in violation of the above written requirements – the City reserves the right to reduce payment for the defective run from MH to MH up to 100%, or request replacement of the entire pipe or a section of the pipe at the contractor expense at the discretion of the City's representative.

2. Wrinkles in the finished liner pipe that cause a backwater of 1/4-inch or more or in any way reduce the hydraulic capacity of the pipe, and are not the result of pre-existing conditions,

are unacceptable and shall be removed and repaired by the contractor at the contractor's expense. The contractor shall remove a section of pipe, if so directed by the City Engineer, to determine if a void between wrinkle and pipe wall exists. If it is so proven that a void does exist, the contractor shall repair and replace that section of pipe at the contractor's expense. If a void does not exist, the contractor shall repair and replace that section of pipe at the City's expense. Methods of repair shall be proposed by the contractor and submitted to the City's representative for review and approval.

PART 2 PRODUCTS

A. Felt Liner with Heat-Cured Resin

1. Liner Tube

a. The liner tube shall consist of one or more layers of flexible needled felt or an equivalent woven and/or non-woven material and shall meet the requirements of ASTM F1216-07b, Section 5.1.

b. The liner tube shall be capable of carrying resin, withstanding installation pressures and curing temperatures, and shall be compatible with the resin system used. The liner shall be fabricated to a size that, when installed, will fit the internal circumference of the existing pipe.

c. The liner shall be fabricated from materials which when cured, will be chemically resistant to and will withstand internal exposure to sewage gases containing quantities of hydrogen sulfide, carbon monoxide, methane, petroleum hydrocarbons, saturation with moisture, diluted sulfuric acid, and other similar chemical reagents.

d. The minimum tube length shall be that deemed necessary by the contractor to effectively span the distance from the inlet to the outlet of the respective manholes, or access points, unless otherwise specified. The contractor shall verify the lengths in the field before impregnation of the tube with resin. Individual insertion/inversions runs may be made over one or more manhole sections as determined in the field by the contractor and as reviewed and accepted by the City's representative.

e. Prior to insertion/inversions, the liner shall be free of all visible tears, holes, cuts, foreign materials, and other defects.

f. The manufactured tube shall be marked along its length at regular intervals not to exceed five feet.

2. Resin

The resin system shall be a corrosion resistant polyester or vinyl ester system including all required catalysts, initiators that when cured within the tube create a composite that satisfies the requirements of ASTM F1216, ASTM D5813, and ASTM F1743, the physical properties herein, and those which are to be utilized in the submitted and approved design of the CIPP for this project. The resin shall produce a CIPP that will comply with the structural and chemical resistance requirements of this specification.

3. Structural Requirements

a. The CIPP shall be designed as per ASTM F1216, Appendix X.1. The CIPP design shall assume no bonding to the original pipe wall.

The heat-cured CIPP liner shall be designed to support hydraulic, soil and live loads. The liner system shall be designed per ASTM F1216-07b, Appendix X.1. The required structural CIPP wall thickness shall be based on the physical properties in Section A.3.b below at a minimum or greater and upon a fully deteriorated gravity pipe condition in accordance with the design equations in Paragraph X1.2.2, Fully Deteriorated Gravity Pipe Condition of Appendix X1. - Design Considerations of ASTM F1216-07b, and the design parameters in Section A.3.c below. The liner wall thickness shall not exceed 8 mm.

b. The heat-cured CIPP shall conform to the structural properties as listed below.

Property	Test Method	Minimum Value per ASTM F1216-07b
Flexural stress	ASTM D790	4,500 psi
Modulus of Elasticity	ASTM D790	250,000 psi
Modulus of Elasticity (enhanced)	ASTM D790	400,000 psi

c. The felt lining with heat-cured resin CIPP shall be designed with the following structural design parameters for the fully deteriorated gravity pipe condition:

1. Design Safety Factor (N) = 2.0
2. Retention Factor for Long-Term Flexural Modulus = 50%-75%
3. Ovality (calculated from (X1.1of ASTM F1216-07b) = 2%
4. Soil density = 120 lbs./cubic foot
5. Live load = HS-20
6. Soil modulus = 1,000 psi
7. Vacuum condition = 0
8. Pipe Condition = Fully Deteriorated
9. Minimum service life = 50 years

10. Groundwater Depth = Assume at surface
11. Soil Depth (above the crown) See Drawings for Existing Sewer Depths
12. Poisson's ratio = 0.3

PART 3 EXECUTION

A Preparation

1. The flow through the pipe shall be diverted and pipe shall be flushed prior to insertion of the CIPP.

2. The contractor shall provide sewage bypass pumping and/or sewage diversion for acceptable completion of the liner installation. Bypass pumping and diversions shall be per Technical Provision 4.

3. It is the contractor's responsibility to notify the residents at each address within the project vicinity at least 48 hours in advance to commencement of work and again prior to any disruption in their service.

4. Cleaning and Inspection of the Existing Sewer. See Technical Provision 2, Sanitary Sewer Main Cleaning and TV Inspection, for more specific requirements.

5. Line Obstructions - It shall be the responsibility of the Contractor to clear the line of obstructions such as solids and roots that will prevent the insertion of CIPP. If pre-installation inspection reveals an obstruction such as a protruding service connection, dropped joint, or a collapse that will prevent the installation process, that was not evident on the pre-bid video and it cannot be removed by conventional sewer cleaning equipment, then the Contractor shall make a point repair excavation to uncover and remove or repair the obstruction. Such excavation shall be approved in writing by the City's Project Engineer prior to the commencement of the work and shall be considered as a separate pay item.

6. The contractor shall protect the manholes to withstand forces generated by equipment, water or air pressure used during the liner installation process.

A. Installation

1. Resin Impregnation

a. The quantity of resin used for tube impregnation shall be sufficient to fill the volume of air voids in the tube with additional allowances for polymerization shrinkage and the potential loss of resin during installation through cracks and irregularities in the original pipe wall, as applicable.

b. The impregnated liner bag shall be transported to and stored at the site in such a manner that it will not be damaged, exposed to direct sunlight, or result in any public safety hazard. The impregnated liner bag shall be kept cool during shipment and storage. All materials shall be subject to inspection and review prior to installation.

2. Liner Installation

a. The wet out tube shall be positioned in the pipeline using either inversion or a pull-in method as defined within relevant ASTM standards previously stipulated. If pulled into place, a power winch or its equivalent should be utilized and care should be exercised not to damage the tube as a result of pull-in friction. The tube should be pulled-in or inverted through an existing manhole or approved access point and fully extend to the next designated manhole or termination point.

b. The liner shall be installed per manufacturer's recommendations.

3. Heat Curing

a. Curing shall be accomplished by utilizing hot water under hydrostatic pressure or steam pressure in accordance with the manufacturer's recommended cure schedule.

b. Temperature shall be maintained during the curing period as recommended by the resin manufacturer's specifications. Temperature gauges shall be placed between the tube and the host pipe's invert position to monitor the temperatures during the cure cycle.

4. Cool Down

a. A cool down process shall be conducted that complies with the resin manufacturer's specification.

b. If the liner fails to make a tight seal at the manhole walls, a seal consisting of a resin mixture compatible with the liner/resin system shall be applied in accordance with the manufacturer specifications.

C. Finished CIPP Requirements

1. Quality Assurance

a. The finished CIPP shall be continuous over the entire length of an installation run, and be free of material defects. The lining shall be impervious and free of any leakage from the pipe to the surrounding ground or from the ground to the inside of the lined pipe.

b. Both ends of the cured liner shall be cut flush at the inlet and outlet points in the manhole. In some cases, when the liner is carried through a straight channel MH, a cut out can be made through the top of the liner inside the MH with the Project Engineer approval only. In this case the bottom of the liner will serve as a continuation of the MH's channel and the edges of the cut out will be sealed watertight with approved epoxy.

2. Liner Defect

a. Any defect, which will or could affect the structural integrity, strength, capacity, or future maintenance of the installed liner, shall be repaired at the contractor's expense, in a manner approved by the City's representative.

D. Watertight End Seals

1. Gaskets

a. Two (2) hydrophilic rubber gaskets shall be installed in the host pipe at both the upstream end and the downstream end of the liner. Outside drop MHs shall have a gasket installed upstream from the drop pipe. The hydrophilic rubber gasket shall be Hydrophilic Expandable Waterstop HYDROTITE CJ-0725-3K or approved equal and shall be glued with LEAKMASTER LV-1 or approved equal.

b. The contractor may propose an alternative sealing material or products in lieu of a hydrophilic rubber joint seal. The proposed alternate shall provide a positive seal between the liner and the existing host pipe, ensuring no tracking through the annulus space and into the manhole. The product must remain in place prior to and during liner installation. If the sealing material is washed away or diluted by flow through the host pipe prior to liner installation, it must be reapplied before installation is allowed to proceed. Any alternative must be approved by the City's representative prior to installation.

c. The seal must be an epoxy or resin mixture compatible with the CIPP system. Seals will be incidental to the CIPP liner. Sealing material and installation method shall be submitted and approved by the City's representative prior to start of construction, and shall conform to the detail drawings provided on the plans. Mortar shall be used: Euclid Chemical "HEY'DI POWDER X" grout or approved equal. Hydraulic cements and quick-set cement products are not acceptable.

E. Service Line Reconnection

1. Service connections must be restored to service connections or laterals within the normal work day. Service connections shall be re-opened without excavation, utilizing a

remotely controlled cutting device, monitored by a CCTV. The Contractor shall certify a minimum of two complete functional cutters plus key spare components are on the job site before each installation or are in the immediate area of the jobsite and can be quickly obtained. Unless otherwise directed by the Owner's representative, all open laterals will be reinstated. All previously capped laterals shall remain capped and unopened. No additional payment will be made for excavations for the purpose of reopening connections.

2. Holes cut through liner will be free from burrs or projections and with a smooth and crack-free edge by brushing. The hole shall be 95 percent minimum and 100 percent maximum of the original service connection diameter. The invert of the service connection shall match the bottom of the reinstated service opening.

3. Miscellaneous pipe debris shall be recovered at downstream manhole and removed.

4. Grouting for service laterals will be required after connection opening.

F. Testing

1. Material Testing

a. CIPP samples shall be prepared for each installation designated by the owner/engineer or approximately 20% of the project's installations. Pipe physical properties will be tested in accordance with ASTM F1216 or ASTM F1743, Section 8, using either method proposed. The flexural properties must meet or exceed the values listed in the table on page 11 of this specification, Table 1 of ASTM F1216 or the values submitted to the Owner/engineer by the contractor for this project's CIPP wall design, whichever is greater.

b. Samples removed for testing will be individually labeled with the following:

- Project Number and Title
- Sample Number
- Segment Number of line as noted on plans
- Date and Time of Sample
- Chain of Custody

c. Samples removed for testing shall be taken at the City's representative's choice. If the contractor samples from inside the line, the location of the coupon shall be repaired. The point repair spot shall be repaired with a method approved by the City's representative. The point repair is at no additional cost to the City.

d. Wall thickness of samples shall be determined as described in paragraph 8.1.6 of ASTM F1743. The minimum wall thickness at any point shall not be less that 87.5% of the submitted minimum design wall thickness.

e. "No Dig" option: At City's representative's option, in lieu of excavation for core samples, the liner shall be run through an 18" long section of line-sized pipe, or an appropriate restraint, to act as a mold for the liner and cured.

2. Field Testing

a. After completion of all liner insertion, service reconnections, and finish work at the manholes, the sewer shall be televised with a color CCTV tilt-head camera recorded on a portable hard drive. Please pay attention that every gasket shall be visible. A portable hard drive shall be provided to the City's representative. See Technical Provision 2, Sanitary Sewer Main Cleaning and TV Inspection for more specific requirements.

G. Reconstruct Manhole Channel

1. Manholes -remove obstructions and irregularities in the channel with appropriate tools and pressure washer then grout the entire channel so the bottom of the channel is even with the newly lined pipes to improve flow through the manhole. In manholes use only an approved by the City's representative hydraulic cement grout to fill and smooth the surfaces. Prepare surfaces according to manufacturer's requirements prior to application. Finished surfaces shall provide an even slope through the manhole with no rise in elevation or protrusions that might inhibit flow.

H. Sectional (Short) Repairs

1. Sectional (short) repairs shall be performed in accordance with ASTM F2599 and all the other requirements of this section.

4. ULTRAVIOLET CURED RESIN

PART 1 GENERAL

A. Reference Specifications, Codes, and Standards

1. In addition to SECTION 3, CURED-IN-PLACE-PIPE, PART 1 GENERAL, subsection B - Reference Specifications, Codes, and Standards, the following references are part of this Specification. In case of conflict between the requirements of this Specification and those of the listed documents,the requirements of this Specification shall prevail. The latest edition of the following references shall be used:

ASTM F2019 Standard Practices for Rehabilitation of Existing Pipelines and Conduits by thePulled in Place Installation of Glass Reinforced Plastic (GRP) Cured-in-Place Resin Pipe (CIPP)

ASTM D543 Test Method for Resistance of Plastics to Chemical

ReagentsASTM D578 Standard Specification Glass Fiber Strands

ASTM D638 Standard Test Method for Tensile Properties of Plastics

PART 2 PRODUCTS

Fiberglass Liner with Ultraviolet (UV)-Cured Resin

A. Liner Tube

1. The fiberglass within the liner shall be non-corrosion (E-CR Glass) material and shall be free from tears, holes, cuts, foreign materials and other surface defects. Its glass fibers must extend in a longitudinal direction to insure no longitudinal stretching during the pull-in process.

2. The liner shall be constructed to withstand installation pressures as required by Manufacturer's recommendations.

3. The liner shall be manufactured to a size that when installed will tightly fit the internal circumference and the length of the original pipe. The tube be able to stretch to fit irregular pipe sections and negotiate bends of up to 20 degrees and shall have sufficient strength to bridge missing pipe sections, with the use of a canvas sleeve if necessary.

4. The liner shall be fabricated from materials which when cured, will be chemically resistant to and will withstand internal exposure to sewage gases containing quantities of hydrogen sulfide, carbon monoxide, methane, petroleum hydrocarbons, saturation with moisture, diluted sulfuric acid, and other similar chemical reagents.

5. Interior and exterior plastics shall be styrene resistant to protect and contain theresin used in the liner.

6. The exterior plastic shall be ultra violet light resistant and translucent to allow visual inspection of the impregnation of the resin within the glass fibers.

7. The wall color of the interior pipe surface of CIPP after installation shall be a light reflective color so that a clear detailed examination with CCTV inspection may be made.

8. The nominal liner wall thickness shall be constructed to the nearest 0.5mm increment.

9. The minimum tube length shall be that deemed necessary by the CONTRACTOR to effectively span the distance from the inlet to the outlet of the respective manholes,

or access points, unless otherwise specified. The CONTRACTOR shall verify the lengths in the field before impregnation of the tube with resin. Individual insertion/inversions runs may be made over one or more manhole sections as determined in the field by the CONTRACTOR and as reviewed and accepted by the City's project manager.

10. Prior to insertion/inversions, the liner shall be free of all visible tears, holes, cuts,foreign materials, and other defects.

11. Prior to insertion/inversions, the CONTRACTOR shall provide data on the maximum allowable stresses and elongation of the tube. The manufactured tube shall be marked along its length at regular intervals not to exceed five feet. These marks shall be used as a gauge to measure elongation during insertion. Should the overall elongation of a reach exceed five percent, the liner tube shall be rejected and replaced.

B. UV-Cured Resin

1. The resin used to impregnate the liner shall produce a cured liner pipe resistant to shrinkage, corrosion, abrasion and shall have a proven resistance to municipal wastewater.

2. The resin shall be a chemically resistant UV cured isophthalic polyester resin or vinyl ester resin (as allowed by the city's project manager). When cured the resin/liner system shall meet the structural and chemical resistancerequirements of ASTM F2019.

C. Structural Requirements

1. The thickness of each liner installed shall be determined using calculation methods that are consistent with applicable ASTMs. The Contractor shall submit stamped and signed designs prior to the installation of any liner. The designs shall include a step by step calculation that shows all equations, defines all variables, lists all assumptions, and clearly indicates all values used for the design.

2. The design engineer shall set the lon 1 g term (50 year extrapolated) Creep Retention Factor at 50% of the initial design flexural modulus as determined by ASTM D790 test method.

3. The CIPP shall be designed to support hydraulic, soil and live loads. The CIPP shall be designed per ASTM F1216-07b, Appendix X.1. The required structural CIPP wall thickness shall be based on the physical properties in Section B.3.d below at a minimum or greater and upon a fully deteriorated gravity pipe condition in accordance with the design equations in Paragraph X1.2.2, Fully Deteriorated Gravity Pipe Condition of Appendix X1. - Design Considerations of ASTM F1216-07b, and the design parameters in Section B.3.e below.

4. The fiberglass liner with UV-cured resin CIPP shall conform to the structural

properties as listed below.

Property	Test Method	Minimum Value
Wall thickness	ASTM D2122 per ASTM F2019	To be determined during design; to a maximum thickness of 8 mm
Flexural strength	ASTM D790	20,000 psi
Flexural modulus	ASTM D790	1,200,000 psi

5. The CIPP shall be designed with the following structural design parameters for the fully deteriorated gravity pipe condition:

- Design Safety Factor (N) = 2.0
- Retention Factor for Long-Term Flexural Modulus = 60%
- Ovality = 2%
- Soil density = 120 lbs./cubic foot
- Live load = HS-20
- Soil modulus = 1,000 psi
- Vacuum condition = 0
- Pipe Condition = Fully Deteriorated
- Minimum service life = 50 years
- Groundwater Depth = Assume at surface
- Soil Depth (above the crown) See Drawings for Existing Sewer Depths
- Poisson's ratio = 0.3

PART 3 EXECUTION

A. Preparation

1. The flow through the pipe shall be diverted and pipe shall be flushed prior to insertion ofthe CIPP.

2. The contractor shall provide sewage bypass pumping and/or sewage diversion for acceptable completion of the liner installation. Bypass pumping and diversions shall beper Technical Provision 4.

3. It is the contractor's responsibility to notify the residents at each address within the project vicinity at least 48 hours in advance to commencement of work and again priorto any disruption in their service.

4. Cleaning and Inspection of the Existing Sewer. See Technical Provision 2, Sanitary SewerMain Cleaning and TV Inspection, for more specific requirements.

5. Line Obstructions - It shall be the responsibility of the Contractor to clear the line of obstructions such as solids and roots that will prevent the insertion of CIPP. If pre-installation inspection reveals an obstruction such as a protruding service connection, dropped joint, or a collapse that will prevent the installation process, that was not evident on the pre-bid video and it cannot be removed by conventional sewer cleaningequipment, then the Contractor shall make a point repair excavation to uncover and remove or repair the obstruction. Such excavation shall be approved in writing by the City's Representative prior to the commencement of the work and shall be considered as a separate pay item.

6. The contractor shall protect the manholes to withstand forces generated by equipment,water or air pressure used during the liner installation process.

B. Installation

1. Resin Impregnation

a. The uncured resin in the original containers and the unimpregnated tube shall be impregnated by vacuum or other means prior to installation. The materials and “wet-out” procedure shall be subject to inspection by the City’s project manager. A resin and catalyst system that is compatible with the requirements of the method shall be used. The manufacturer shall provide certification that this process has been completed correctly.

b. The impregnated liner bag shall be transported to and stored at the site in such amanner that it will not be damaged, exposed to direct sunlight, or result in any public safety hazard. The impregnated liner bag shall be kept cool during shipment and storage. All materials shall be subject to inspection and review prior to installation.

2. Liner Installation

Liner Installation shall be in accordance with applicable ASTM F2019, Section 6.4, and the following:

a. Liner protection – Prior to inserting the Liner, a plastic sheet 10 mil thick will be pulled intothe host pipe to protect the Liner from damage as the Liner is pulled in.

b. The Liner shall be pulled-in through an existing manhole or approved access point and fullyextend to the next designated manhole or termination point. The pulling speed shall not exceed 15 ft/min. Care shall be exercised not to damage the tube during the pulling phase.

c. Liner Inflation – The Liner shall then be inflated with air with sufficient pressure to hold theLiner tight to the host pipe wall.

d. The Contractor shall staff this project with the key individuals who were approved by thecity and who will be available for the project duration. Failure to produce the listed individuals during the Project shall be cause for terminating the Contract or for delaying atno cost to the Owner until said individuals are available. Delay claims caused by such failure shall NOT be allowed. Contract time shall NOT be extended due to the above mentioned personnel being unavailable to work on this Project at all times.

e. Liner Inspection – The Contractor will video record the Liner prior to commencement of the curing process, and make the recording available to the city's project manager upon request.

C. UV Light Curing

CIPP curing shall be in accordance with applicable ASTM F2019, Section 6.6 and 6.7, with the following modifications:

1. The ultraviolet curing lamps shall operate in a sufficient frequency range to insure the required curing of the resin.

2. A camera must be located on the ultraviolet light assembly to enable the video inspection of the Liner and to insure that the Liner has been properly inflated and any liner problemscan be identified before curing begins.

3. The Contractor will submit a documented record of time, rate of travel of the ultraviolet light assembly, and internal temperatures and pressures during the curing process to theCity's project manager upon request.

5. SEWAGE DIVERSION REQUIREMENTS

PART 1 GENERAL

A. Description

1. This section includes all labor, materials, equipment, and incidentals necessary for the diversion of flow in the sanitary sewer main lines. Work under this section shall include, but not be limited to: pumps, pump motors, pipes and traffic control for the use in diverting flow in the sewer main lines while the CIPP lining is installed.

B. By-Pass Pumping Plan

1. The contractor shall submit a "Flow Diversion and By-Pass Pumping Plan" to the City's representative prior to the start of construction. Under no circumstances shall sewage be allowed to flow or leak onto the ground surface, into gutters or onto streets, over sidewalks, or into storm inlets. All diverted sanitary sewage shall be discharged back to the existing sanitary sewer system. The Flow Diversion and By-Pass Pumping Plan shall outline the contractor's proposed method of handling all flows during all elements of construction. The flow through the pipe shall be diverted and pipe shall be flushed prior to insertion of the CIPP. The plan shall show all flow inputs (connections) in the work area and how the flow from each connection will be managed. Flow inputs shall be confirmed by the contractor during initial field surveys and television inspections. The contractor shall provide complete diversion regardless of flow rate. Additionally the plan shall contain, at a minimum, a plan view of each proposed diversion on a site map and the individual components of the diversion including but not limited to:

    a. Pumps: type, size and placement
    b. Diversion pipe: size, type, and placement
    c. Power supply to pumps
    d. Method of damming the flow
    e. Facilities for redundancy

2. The pumping or transportation capacity shall be sufficient to maintain peak flow conditions that may occur during a rainstorm.

PART 2 PRODUCTS

A. Equipment

1. The contractor shall use critically silenced generators and pump units with hospital-grade mufflers and shall meet or exceed the requirements of any local noise ordinances. Such approved generators and accompanying pumps shall be continuously monitored while in operation and shall be placed to minimize disturbances to residential areas. If necessary to meet noise ordinances, sound baffles and temporary sound walls shall be installed to deflect sound from generators and bypass-pumps away from residential areas or as directed by the City's representative.

2. Each flow diversion pump shall be powered by a dedicated power generator and shall operate as a single pumping unit. For system redundancy, the contractor shall have on site an equivalent back-up flow pumping unit for each pumping operation.

3. Flow diversion piping and pumps shall be free of leaks. Leaking pipes and pumps shall be replaced immediately. Sewage spills shall be cleaned up immediately. If a sewage release occurs during any sewage diversion activity, the contractor shall be responsible for taking immediate action to cease, contain, and clean up the release, and to notify the proper

authorities. The contractor shall have sufficient equipment and materials at the work site to cease, contain and cleanup any sewage release that occurs during diversion operations and will be responsible for all costs associated with sewage spill cleanup including associated fines. The contractor shall be responsible for cleanup, repair, property damage costs and claims.

4. Flow diversion piping shall be buried or arranged such that the piping is protected from traffic loads, traffic is maintained at driveways and roadways, and sidewalks are free of obstruction unless otherwise approved by the City's representative. All sewage diversion piping shall be water-tight. Surface restoration that is required for installing flow diversion piping and other appurtenances is incidental to the flow diversion and by-pass pumping pay item.

PART 3 EXECUSION

A. Operation

1. The contractor shall provide a qualified operator who is capable of making emergency repairs or who is able to mobilize forces to handle power, pump or other problems. This operator shall be on site immediately near the pumping system at all times.

2. No flow diversion operations may proceed unless the contractor has, at the work site, the following items:

   a. Dry granular lime, of sufficient quantities, to be spread on any release for purposes of disinfectant. A 10% bleach solution may also be used as a disinfectant. Disinfectants may not be directly applied to any surface waters, streams, creeks, etc.
   b. Equipment to secure the area of sewage release and isolate the public from accessing the release site. As a minimum this shall include barricades and caution tape.
   c. The equipment and materials on hand to stop the release and repair the failed item.
   d. Equipment and materials to clean the site, rake up solid debris and to dispose of material properly.

3. The contractor shall make all provisions necessary to restore normal sewer operation at the end of each day.

4. Upon completion of construction, all flow diversion piping and pumps and related facilities shall be removed and all affected areas restored to their prior condition.

B. Spillages

1. In case of sanitary sewage release during diversion operations, the contractor shall

immediately contact the City of West Linn On-Site Project Inspector notifying them of the release.

2. If the Project Inspector is not capable of being immediately notified, then contact the City of West Linn Public Works Operations. The following telephone numbers shall be used:

   a. (503) 656-6081
   b. (503) 849-5038
   c. (503) 742-8620

3. The representative of the City of West Linn shall report the sewage spill within 24 hours to the Oregon Department of Environmental Quality and any other appropriate entities. Even if a sewage spill or release is contained within an excavation, the spill or release must be reported.

4. Failure by the contractor to report a spill or release to the appropriate City representative will result in liquidated damages in the amount of $500.00 per incident plus an amount sufficient to reimburse the City for any civil and administrative penalties paid by the City as a result of the contractor's failure to report as described above.

5. The contractor shall be responsible for providing the following information to the authorities in case of a spill or release:

   a. Release location
   b. Date and time release found or started and time stopped
   c. Release flow rate and estimated total volume
   d. Receiving stream, if any
   e. Action taken to stop release
   f. Cause of release
   g. Clean-up actions taken
   h. Any other information as requested by relevant authorities

6. MEASUREMENT AND PAYMENT

A. Bid Item 1 – Mobilization/Demobilization

Payment for mobilization/demobilization will be made as a portion of the lump sum price. Actual percentage shall be shown in the Estimated Quantities column. The actual payment amount for "Mobilization/Demobilization" included in partial payments will be determined as follows:

Mobilization shall include moving personnel, equipment, supplies and incidentals to the project site. Demobilization shall include final cleanup, removal of equipment, supplies and incidentals from the project site.

B. Bid Item 2 – Traffic Control

1. Payment for "Traffic control" shall be made as a portion of the lump sum price. The lump sum price paid for temporary traffic control system shall include full compensation for furnishing all labor for flagging, materials, tools, equipment, and incidentals, for doing all work involved in placing, removing, storing, maintaining, moving traffic control devices required for temporary protection and direction of traffic through or around the work area.

2. Temporary traffic control shall be in accordance with the ODOT Temporary Traffic Control Handbook. Street closures will not be allowed without authorization of the City Engineer. The City reserves the right to restrict work for specific holidays or events.

C. Bid Item 3 – Sanitary Sewer Pipe Cleaning

1. Payment for cleaning of sanitary sewer pipes to be lined will be paid for on a per linear foot basis. Measurement will be based on the total length of sewer pipe cleaned. Removal of obstructions and roots will be considered incidental to this item.

2. The contract price paid per linear foot for sanitary sewer pipe cleaning shall include full compensation for furnishing all labor, materials, tools, equipment, and other incidentals to perform the work, including cleanup.

D. Bid Item 4 – Video Inspection (Pre – CIPP)

1. Payment for video inspection of the sewer pipe following the cleaning, but prior to the installation of the cured-in-place pipe, will be on a per linear foot basis. The hard drive will be delivered to the City after completion of the pre-video inspection work. Measurement will be based on the total length of sewer pipe videoed, and shall be confirmed by a hand wheel measurement from manhole to manhole. Flow by-pass shall be conducted, if necessary, during pre- video inspection and will be considered incidental to this pay item. See Technical Provision 2, Sanitary Sewer Main Cleaning and TV Inspection.

2. The contract price paid per linear foot for video inspection of sanitary sewer pipe prior to CIPP installation shall include full compensation for furnishing all labor, materials, tools, equipment, and other incidentals to perform the work.

E. Bid Item 5 – Furnish and Install 8-inch Diameter CIPP

1. Payment for furnishing and installing the cured-in-place pipe liner including all work and materials will be on a per linear foot basis. Measurement will be based on the total length of cured-in-place pipe installed. All surface restoration shall be considered incidental to the installation cost.

2. The contract price paid per linear foot for installation of 8-inch cured in place pipe liner shall include full compensation for furnishing all labor, materials, tools, equipment, testing and other incidentals to perform the work, including cleanup. See Technical Provision 3, Cured-in-Place Pipe.

F. Bid Item 6 – Furnish and Install 10-inch Diameter CIPP

1. Payment for furnishing and installing the cured-in-place pipe liner including all work and materials will be on a per linear foot basis. Measurement will be based on the total length of cured-in-place pipe installed. All surface restoration shall be considered incidental to the installation cost.

2. The contract price paid per linear foot for installation of 10-inch cured in place pipe liner shall include full compensation for furnishing all labor, materials, tools, equipment, testing and other incidentals to perform the work, including cleanup. See Technical Provision 3, Cured-in-Place Pipe.

G. Bid Item 7 – Furnish and Install 12-inch Diameter CIPP

1. Payment for furnishing and installing the cured-in-place pipe liner including all work and materials will be on a per linear foot basis. Measurement will be based on the total length of cured-in-place pipe installed. All surface restoration shall be considered incidental to the installation cost.

2. The contract price paid per linear foot for installation of 12-inch cured in place pipe liner shall include full compensation for furnishing all labor, materials, tools, equipment, testing and other incidentals to perform the work, including cleanup. See Technical Provision 3, Cured-in-Place Pipe.

H. Bid Item 8 – Furnish and Install 15-inch Diameter CIPP

1. Payment for furnishing and installing the cured-in-place pipe liner including all work and materials will be on a per linear foot basis. Measurement will be based on the total length of cured-in-place pipe installed. All surface restoration shall be considered incidental to the installation cost.

2. The contract price paid per linear foot for installation of 15-inch cured in place pipe liner shall include full compensation for furnishing all labor, materials, tools, equipment, testing and other incidentals to perform the work, including cleanup. See Technical Provision 3, Cured-in-Place Pipe.

I. Bid Item 9 – Furnish and Install 6-inch Diameter CIPP

1. Payment for furnishing and installing the cured-in-place pipe liner including all work and

materials will be on a per linear foot basis. Measurement will be based on the total length of cured-in-place pipe installed. All surface restoration shall be considered incidental to the installation cost.

2. The contract price paid per linear foot for installation of 6-inch cured in place pipe liner shall include full compensation for furnishing all labor, materials, tools, equipment, testing and other incidentals to perform the work, including cleanup. See Technical Provision 3, Cured-in-Place Pipe.

J. Bid Item 10 – Video Inspection (Post – CIPP)

1. Payment for performing a video inspection of the sewer pipe following the installation of the CIPP and recording onto a portable hard drive will be on a per linear foot basis. Measurement will be based on the total length of cured-in-place pipe video. Waterstop gaskets shall be seen at both ends of new liner. See Technical Provision 2, Sanitary Sewer Main Cleaning and TV Inspection. Flow by-pass and flushing shall be conducted, as part of post- video inspection and will be considered incidental to this pay item.

2. The contract price paid per linear foot for video inspection of sanitary sewer pipe following CIPP installation shall include full compensation for furnishing all labor, materials, tools, equipment, and other incidentals to perform the work, including cleanup.

K. Bid Item 11 – Sanitary Sewer Bypass Pumping

1. Payment for providing necessary sanitary sewer bypass pumping in accordance with all local, state, and federal regulations will be paid on a lump sum basis. Measurement will be based on the percentage of the CIPP work completed.

2. The contract lump sum price paid for bypass sanitary sewer pumping shall include full compensation for furnishing all labor, materials, tools, equipment, and other incidentals to perform the work, including clean up. Actual percentage of Sanitary Sewer Bypass Pumping to the total bid price, excluding Sanitary Sewer Bypass Pumping, shall be shown in the Estimated Quantities column. See Technical Provision 4, Sewage Diversion Requirements.

L. Bid Item 12 – Protruding Lateral/Object Trimming

1. Payment for trimming protruding service laterals and other foreign objects to ensure that no edges exist or material for the CIPP liner to catch on. Measurement will be based on each service laterals or objects trimmed.

2. The contract price paid per trimming protruding service laterals or other objects complete in place, shall include full compensation for furnishing all labor, materials,

tools, equipment, and other incidentals to perform the work, including clean up.

M. Bid Item 13 – Lateral Reinstatement

1. Payment for reinstating all active services and those to vacant lots. Measurement will be based on each service laterals reinstated.

2. The contract price paid per lateral reinstatement complete in place, shall include full compensation for furnishing all labor, materials, tools, equipment, and other incidentals to perform the work, including clean up.

NOTE:

The winning bidder will be determined using the Bid Form. Unit Prices on all attachments shall match the Unit Prices on the Bid Form. Mobilization/Demobilization, Temporary Traffic Control and Sanitary Sewer Bypass Pumping items shall have Lump Sums percentages shown.